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Æcidium on Juniperus Virginiana.[1]

W. G FARLOW.

During a visit to Bermuda in the winter of 1881 I examined the cedars, *Juniperus Bermudiana* L., which everywhere abound, in order to ascertain whether they were infested by peculiar species of Gymnosporangium. I was unsuccessful in my search and, as far as could be seen with the naked eye, the cedars were free from any species of Uredineæ. The twigs of some trees growing near Paynter Vale on Castle Harbor, however, bore roundish galls attached on one side to the twigs which resembled the distortions caused by Gym. globosum on J. Virginiana in the United States. It was only after an examination with a hand lens that insignificant spots were detected which, seen in section under a higher power, were found to be due to the presence of an æcidium. My specimens were collected in February and, at that date, the peridia hardly protruded beyond the surface of the galls, and in some cases had not opened at all. I hastily assumed that better material could be obtained later in the season and, at my request, Dr. Walter Faxon, who subsequently visited Bermuda in mid-summer, kindly sent me galls collected in July. Contrary to my expectation the fungus was not in so good a condition as in the material collected in February, and a re-examination of my own specimens convinced me that the æcidium on them was past its prime in spite of the fact that a few peridia were not open.

In the spring of the present year I received from Mr. F. S. Earle some twigs of J. Virginiana collected at Ocean Grove, Miss., in January, on which were galls not more than quarter of an inch in diameter, not more than half the size of those on J. Bermudiana and fresher, with the color of mahogany. If the galls on J. Bermudiana looked like old galls of Gym. globosum of several years' standing, those on J. Virginiana looked quite as much like the young first-year's galls of the same species. The specimens collected by Mr. Earle had æcidia essentially the same as those that I have found in Bermuda but in better condition for study, so that it

[1]Read at the meeting of the A. A. A. S., in New York, August 15, 1887.

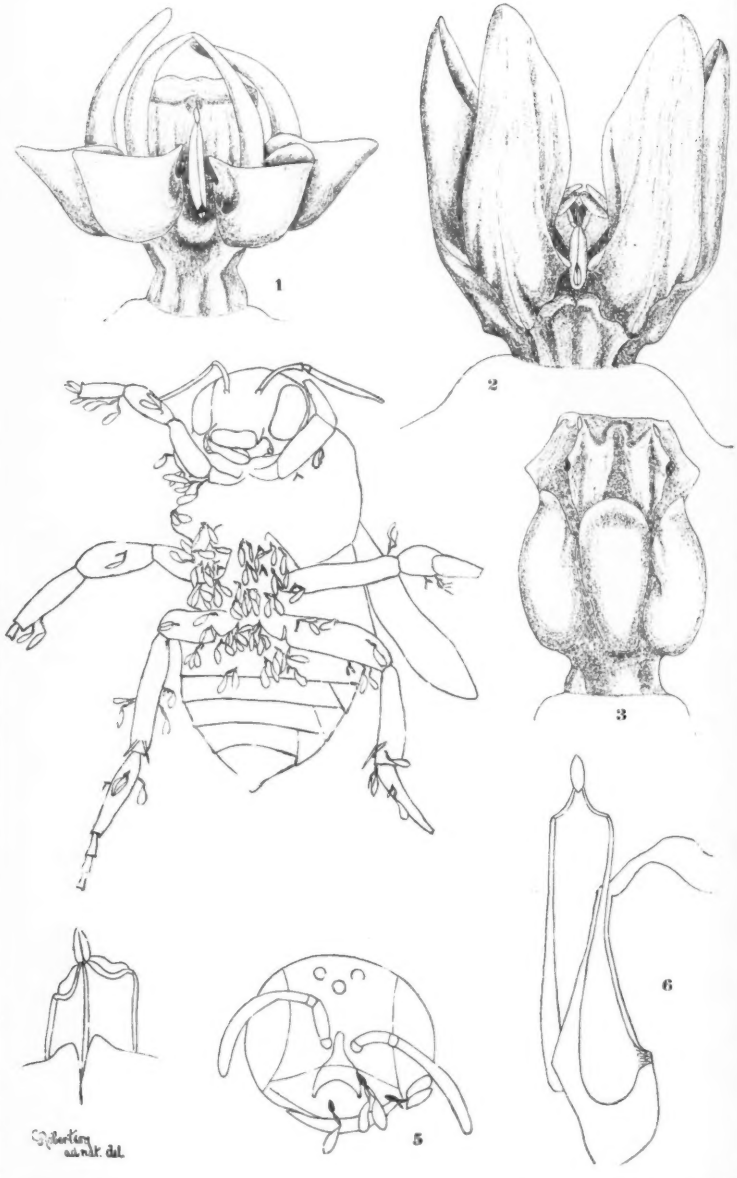
is probable that the fungus which I consider to be the same in both cases is in perfection in December and January. Compared with other Uredineæ which grow on Coniferæ, the æcidium in question, apart from the galls which indicate its presence, is decidedly less conspicuous, and an excellent observer of plants, Mr. Wm. Peniston, who lives close to the affected trees at Paynter Vale, assured me that he had never noticed any yellow or brown fungi on the galls.

The occurrence of an æcidium on Juniperi, which produces distortions resembling those of a Gymnosporangium, has not hitherto been suspected and, as no similar form is known to me, the species may be described as follows:

ÆCIDIUM BERMUDIANUM n. sp.—Gall perennial, globose or subreniform, when young often distinctly lobed, surface at first mahogany-colored becoming darker with a honeycombed surface, ¼–½ inch in diameter. Æcidia minute, about .20 mm. broad, .20–.25 mm. high when mature. Peridial cells oval or elliptic, .038×.05 mm. average, surface covered with sinuous slightly raised ridges. Spores brownish, usually polygonal in outline, rarely spherical, .019–.023 mm. in diam., surface smooth or only very slightly roughened.

On the smaller branches of *Juniperus Bermudiana* and *J. Virginiana*. Winter. Bermuda *(Farlow)*. Mississippi *(Earle)*.

Whether this æcidium is connected with any Gymnosporangium is very doubtful. No species of that genus is yet known in Bermuda and the æcidia of the Gymnosporangia of the Southern United States, as determined by the cultures of Thaxter and others, are supposed to be well known Rœsteliæ growing on Pomeæ with the exception of Gym. globosum, a species in which cultures have given only negative results as yet. There are two facts, however, which would lead us to hesitate before thinking that there is a connection between Æc. Bermudianum and Gym. globosum. The latter species is very common in the Northern States on J. Virginiana, while Æc. Bermudianum is known only near the sea in the extreme South. Furthermore, in the cases which have been carefully studied, the Gymnosporangia occur in the spring and the æcidia forms come later in the season. Æc. Bermudianum, on the contrary, develops in mid-winter just before the appearance of the Gymnosporangia in the Southern States, and if we believe that the two forms are connected, we must recognize an interval of at least seven months between the disappearance of the teleutosporic form and the apearance of the æcidial form. It is more prob-



ROBERTSON on ASCLEPIADS.

able that the present æcidium has no connection with our known Gymnosporangia, and that its other stages may very likely be traced to other Uredineæ which inhabit warmer regions near the Gulf of Mexico and the Atlantic. The resemblance of the galls in the two fungi is certainly curious.

The relation of Æc. Bermudianum to the Rœsteliæ already known in the United States is not very close. A differential diagnosis is hardly necessary, for the characters above will be recognized as sufficiently marked by those who study this group of plants. The species which in the microscopic characters of the spores and peridial cells comes nearest to the present species is *R. lacerata* Cooke, which grows on Cratægus in the Southern States. In the distortions produced, the absence of ridges on the peridial cell, and several other respects, the differences between the two are decided. It is to be hoped that observers in the field will gather more information about this curious fungus.

Insect relations of certain Asclepiads. I.

CHARLES ROBERTSON.

(WITH PLATE XII.)

ASCLEPIAS VERTICILLATA.—The gynostegium is very small, the anther wings measuring about one and two-fifths millimetres. It fastens the corpuscula almost exclusively upon the hairs of the legs of insects; and, in this respect, shows a strong contrast even with A. incarnata. While the corpuscula of the latter are sometimes found on the tips of the claws of the largest visitors, Bombus and Sphex, those of this plant are rarely found even on the claws of the smallest, Ceratina dupla, Halictus, and Cerceris compacta (?). Of ninety-two specimens bearing corpuscula, eighty-eight have them on hairs alone, and four on the hairs and claws. That is, one specimen in twenty-three has them on its claws, while about one in three of those bearing corpuscula of A. incarnata has them on its claws. As the wings increase in size in the three following species, corpuscula are attached more frequently to the claws and less often to the hairs. Eight specimens show pollinia on their tongues. There is quite a contrast between this species and A. incarnata, in respect to the formation of combinations of corpuscula. A. verticillata does not form them so readily; and, in

fact, does not need to, as it is better adapted to fix its corpuscula directly upon the insect. On account of the shortness of the hoods, the position of the corpuscula on the legs of insects depends on how much the length of the legs exceeds that of the slits. The feet of the smallest visitors reach below the angles of the wings, and corpuscula are found on their tarsi. Large insects, bumble-bees, have pollinia on hairs from the claws to the middle of the tibiæ. I have found no dead insects on the flowers.

Associated with a gynostegium of the character indicated above we find hoods which are very broad and shallow, being not much over half as deep as those of A. incarnata. They open considerably below the level of the style-table, and their tips are turned outward, (fig. 1.)

Compared with A. incarnata, this species shows a marked increase in insects of small size and short tongues, Halictus, Odynerus, Cerceris, Crabro, Pompilus, Priocnemis, Myzine, and fewer long tongues. If it had been observed to the same extent and under as favorable conditions, it would show many more species of Hymenoptera. As the hoods increase in depth from this through A. incarnata, Cornuti, and Sullivantii, long tongued bees increase in number of individuals, while the number of species of Hymenoptera decreases. The number of species of butterflies in the table is quite misleading. The most common were small ones, which seldom remove pollinia of any Asclepias, the large species being represented by only one or two individuals of each.

In color, accessibility of nectar, and, consequently, in the general character of its insect visitors, A. verticillata shows more resemblance to certain Umbelliferæ than to the other species referred to in this paper.

Observations were made in a patch about fifteen feet long and four feet wide, on ten days, between July 20 and August 21.

	Hymenop.	Butterflies.	Other Lepidop.	Diptera.	
With pollinia	31	4	...	4	39
Without pollinia	9	11	1	7	28
	40	15	1	11	67

ASCLEPIAS INCARNATA.—The small anther wings are adapted to fasten the corpuscula upon the legs of large insects from the claws to the middle of the tibiæ, and on the claws and tarsal hairs of the small ones; but they catch the hairs much more frequently. Of 153 specimens bearing corpuscula, 103 have them on the hairs alone, 42 have them on the hairs and claws, and 8 on the claws alone; or, 145 have pollinia on the hairs, and 50 have them on the claws. That is, about one-third of the specimens bearing pollinia have the corpuscula attached to their claws. These processes are not so easily caught, because they are so large. Corpuscula are sometimes found on the tongues also, as I have found in 29 out of 156 specimens, 3 of these bearing them on the tongues alone. Combinations of corpuscula are formed much more readily than in A. verticillata. Sometimes a dead insect is found on the flowers. This occurs only when all or most of the feet are entangled simultaneously, so as to render the insect absolutely helpless. I have found Pelopœus cementarius and a Colletes killed in this way. As the flowers become larger, in the next two species, insects are killed more frequently.

The hoods are comparatively broad and shallow, and their tips do not project beyond the anthers. The visitors are more miscellaneous than those of the other species we have to consider.

The most abundant insects observed by me on the flowers were bumble-bees, especially Bombus separatus, wasps (Sphex and Tachytes) and butterflies (Papilio and Danais). Notes were made in a patch covering two or three acres, on twenty-one days, between July 22 and August 21.

	Hymenoptera.	Butterflies.	Other Lepidop.	Diptera.	Coleoptera.	Hemiptera.	
With pollinia	38	15	...	3	3	1	60
Without pollinia	5	5	1	4	3	1	19
	43	20	1	7	6	2	79

ASCLEPIAS CORNUTI.—The anthers are much larger than in the preceding, and, as a consequence, the corpuscula are fastened to the claws of insects more frequently. The tarsal hairs are not readily caught unless they are

long. However, corpuscula are found more frequently on the pulvilli and on the hairs near the claws than on the claws. Even when small and short-legged insects succeed in extracting pollinia and inserting them into the stigmatic chambers they have great difficulty in breaking the retinacula, and often lose their lives in consequence. Hive-bees are frequently killed when most of their feet are entangled. On June 24 I picked thirty dead hive-bees from the flowers.[1] I have also found five species of flies and four species of moths killed on the flowers.

The hoods, although hardly longer than the anthers, are comparatively broad and deep, favoring long-tongued bees, which are the most abundant visitors.

As butterflies have been found on the preceding plants, they would be expected to occur on A. Cornuti. H. Müller gives a list of thirty-one species of insects observed on the flowers in Europe.[2] No butterflies are mentioned, but three species of Lepidoptera of other families, on which pollinia were not found. In Illinois I caught seventeen species on the flowers, six of these showing pollinia.

Notes were made on twenty-two days, between June 21 and July 22.

	Hymenop.	Butterflies.	Other Lepidop.	Diptera.	Coleoptera.	Hemiptera.	
With pollinia	10	6	1	7	1	3	28
Without pollinia	7	11	5	8	4	1	36
	17	17	6	15	5	4	64

ASCLEPIAS SULLIVANTII.—The anther wings are large and strong, the slits being fully one millimetre longer than in A. Cornuti. At the angles, the wings diverge strongly[3] so as to catch the divergent claws; and this is the only Asclepiad I have observed which fastens its corpuscula upon the claws more frequently than upon the other processes. The few small insects which occur on the flowers rarely get their claws caught, and, when they do, rarely escape.

[1] W. H. Leggett found dead hive-bees on some Asclepias, probably Cornuti, but does not mention the species. See *Amer. Naturalist*, iii, 388.

[2] "Fertilization of Flowers," 399, 400; also, "Befruchtung der Blumen," 336, and "Weitere Beobachtungen," iii, 61.

[3] See BOTANICAL GAZETTE, xi, plate viii.

The great number of hive-bees killed on the flowers of this plant and of A. Cornuti, besides being a matter of curiosity, and, indeed, of economic importance, is interesting in the study of the insect relations of the different species. Dead hive-bees are found on the flowers of A. Sullivantii much more frequently than on A. Cornuti. From the flowers of a patch which bore fifty-two follicles, I picked 147 dead hive-bees, from which it seems that the flowers are better adapted to kill hive-bees than to produce fruit through their aid. On seventeen days between July 2 and 27, 1885, I visited a patch to collect the insect visitors, and picked 671 from the flowers. I have often found four, and, in one case, seven dead bees on a single umbel. The intervals between my visit were such that many bees must have escaped my counting by being blown off by the wind, carried away by insects, or by falling with the flowers.

Most of the bees observed on the plants were trying to escape from the flowers. Of those which escape, many leave some of their tarsi between the anther wings, and must often die in consequence. These broken tarsi interfere with the insertion of the pollinia, and stop the claws in their passage through the slits. Many bees which might escape are killed by rain, for I have observed a marked increase in the number of dead bees on days following showers. Many fall a prey to predaceous insects. I have seen them, while still alive, attacked by ants, spiders and Podisus spinosus. I believe the Podisus frequents the flowers to prey upon the insects thus entangled.

There are two ways in which the flowers may bring disaster to hive-bees. It is common to find corpuscula, with their pollinia, fixed to some part of the tongue, and these bodies may interfere with the insertion of the tongue into narrow nectaries. Then, the corpuscula cover the claws so that the feet slip, and pollination is sometimes facilitated in this way. If the bee escape from the flowers with its tarsi, its trouble is not over, for it may lose its life on account of the claws being blunted by the corpuscula.[4]

Besides hive-bees, species of Megachile, Halictus, Astata, Lucilia,[5] Trichius, Pamphila, and Scepsis were found dead on the flowers.

[4] See R. Bickford, *Am. Naturalist*, ii, 655. J. Kirkpatrick says: "When the claws are thus fettered, the bee can not climb upon the combs nor collect honey, and is soon expelled from the hive and must die. The unfettered bees tumble them out with little ceremony." *Am. Nat.*, iii, 109.

[5] The Diptera mentioned in this paper were kindly determined for me by Dr. S. W. Williston.

The large obovate hoods project half their length beyond the anthers, which increases their depth, and makes small insects less likely to become entangled. The structure of the hoods and the great difficulty smaller insects have in effecting pollination convince me that bumble-bees have had most influence in modifying the flowers, and they are the most common visitors except hive-bees.

It is to be remembered that hive-bees do not belong to our fauna, so that an adaptation to these flowers was not to be expected. By their great abundance, their constant efforts to escape, with the fact that their dead bodies occupy the flowers and give forth a disagreeable odor, they have produced a well marked disturbance of the insect relations of this plant.

	Hymenop.	Butterflies.	Other Lepidop.	Diptera.	Coleoptera.	Hemiptera.	
With pollinia.....	6	4	...	...	...	...	10
Without pollinia.....	10	7	2	3	1	1	24
	16	11	2	3	1	1	34

ASCLEPIAS TUBEROSA.—The anther wings are very delicate, as in A. verticillata, and are adapted to catch the tarsal hairs. Of many specimens bearing pollinia, two small bees, Cœlioxys and Augochlora, are the only ones with corpuscula on their claws.

The hoods are long and narrow, and their tips project far beyond the anthers, so that the nectar is only readily accessible to long and thin tongues.

The long tips also hold the bodies of insects so far above the angles of the wings, that only those with long legs easily remove the pollinia. The bright orange-red color of the flowers and the structure of the hoods suggest adaptation to butterflies, and the small anther wings seem to be especially suited to them. The claws of these insects are rather straight, and, when not in use, are held close together and directed in line with the leg; so that they do not often enter the slits. Whenever I have compared them, it has seemed that butterflies have corpuscula on their claws less frequently than do Hymenoptera. Of fifty-three specimens bearing Asclepias pollinia, only eight have them on their claws.

Notes were made on a few scattered plants on eighteen days between June 23 and August 17. This is the only species on which no bumble-bee was seen. By far the most abundant visitors are the butterflies.

	Hymenop.	Butterflies.	Other Lepidop.	Diptera.	
With pollinia	6	7	1	1	15
Without pollinia	3	4	...	...	7
	9	11	1	1	22

ASCLEPIAS PURPURASCENS.—The anther wings catch the hairs of the tarsi in all of the cases observed.

The hoods of the reddish purple flowers are long and narrow, their tips being much longer than the anthers (fig. 2). In the back of the hood is a process which projects inward to meet the broad horn, and thus completes the partition between the very narrow honey receptacles.

In my neighborhood A. purpurascens blooms first, when bumble-bee workers and Sphegidæ are least abundant, and shows a greater preponderance of butterflies than in A. tuberosa.

I watched a few plants on seven days between June 2 and 19.

	Hymenop.	Butterflies	Diptera.	Hemiptera.	
With pollinia	1	5	1	1	8
Without pollinia	5	11	...	...	16
	6	16	1	1	24

ASCLEPIAS IN GENERAL.—The hoods are broad so that the intervals between them are narrow. In order that the legs of insects may be readily caught between them, they project strongly throughout and are open at the summit.

The open mouths are also of advantage in making the flowers more conspicuous, but are to some extent a disadvantage, since they make the nectar more accessible to many insects which are useless. The horn partly offsets this disadvantage. But for its presence small insects could crawl bodily into the hoods of the larger flowers. The horn has also the effect of making the nectar more or less double, notably in A. purpurascens; and I have observed in A. Cornuti and Sullivantii that bumble-bees insert their tongues regularly on each side of it.

Since a small gynostegium can catch more processes on an insect's leg, and so can fasten more corpuscula directly upon the insect, the habit of forming combinations of corpuscula[6] is less important to flowers having it. I have found no combinations of corpuscula of A. tuberosa, and few small ones of verticillata. (1) One advantage of their formation, and a ready explanation of their frequency in certain species, as A. incarnata, is to be found in the fact that the broken retinacula are often more easily caught by the wings than the hairs. Often the hairs are so short that they do not easily enter the slits; but when a corpusculum comes to be fastened to one of them advantage is taken of the circumstance, and a large combination is attached to its retinacula. For example, a specimen of Apathus elatus has six corpuscula on its tongue, all in one combination, illustrating the fact that it is often easier for A. incarnata to fasten a combination to a hair that is once caught than to catch another of the same length. (2) Long combinations are sometimes guided by the hoods over the angles of the wings, when the leg bearing them is not so guided (A. incarnata). I have seen pollinia of A. Sullivantii near the end of a combination drawn into the stigmatic chamber when the foot of the bee did not reach down to the angle. (3) After a corpusculum is fastened to every available process the carrying capacity of the leg is still indefinitely increased. This is so important in the large flowered species that I do not believe they could have been developed until this habit had become fixed in the smaller flowers. On the pulvillus of a hive-bee's foot I found a combination of eighteen corpuscula of A. Cornuti. But for the broken retinacula, it would have required every foot to carry these corpuscula, and then no new ones could have found room for attachment.

[6] For figures of these combinations, see Corry's paper, Trans. Linn. Soc., Ser. 2, Bot., Vol. II, pl. 25.

The frequent occurrence of these combinations spoils the theory that the corpuscula enter the stigmatic chamber. That view can neither explain how they are formed nor how they escape destruction.

While in ordinary flowers an insect may be a useful visitor if it can reach the nectar, in Asclepias many other conditions influence the insect relations. (1) Of visitors whose tongues are suited to the nectaries, many are useless, because they do not light upon the flowers (Sphingidæ, Ægeriadæ and Trochilus).[7] (2) Others because their legs are not long enough to extract pollinia. Megachile is common on A. tuberosa, but never, so far as observed, carries pollinia. (3) Others have legs long enough, but rest their feet so lightly on the flowers that they seldom effect pollination; e. g., Diptera and small butterflies. (4) Still others are not strong enough to free their claws from the slits and break the retinacula; in all, seventeen species were found to be killed on this account.

The table shows the number of species visiting the flowers, with the disposition of the corpuscula on them.[8]

	Hymenop.	Butterflies.	Other Lepidop.	Diptera.	Coleoptera.	Hemiptera.	
Corpuscula on hairs, claws and tongue.....	14	...	...	...	2	...	16
" " hairs and claws	8	7	...	...	...	1	16
" " hairs and tongue.....	5	1	...	3	...	...	9
" " hairs alone.....	26	15	1	7	2	3	54
" " claws alone.....	3	...	...	...	...	...	3
" " tongue alone	1	...	...	2	...	...	3
" none	13	12	6	13	5	...	49
	70	35	7	25	9	4	150

The most striking peculiarity of Hymenoptera is the frequent occurrence of pollinia on their tongues. Of twenty-eight species with pollinia in that situation, twenty are Hymenoptera. Bembex which resembles certain Syrphidæ[9] in

[7] The ruby-throated humming-bird visits A. incarnata, Sullivantii and purpurascens.

[8] In the table the pulvilli are included under "hairs."

[9] Packard, "Guide to Study of Insects," 164.

colors and manner of flight, also imitates them in resting lightly on the flowers and extracts pollinia less frequently than any wasp I have seen.

EXPLANATION OF PLATE XII.—Fig. 1, Gynostegium of *Asclepias verticillata* L., with one hood removed. Fig. 2, Same, of *Asclepias purpurascens* L. Fig. 3, Gynostegium of *Acerates longifolia* Ell. Fig. 4, Sketch of *Bombus scutellaris* Cress., with pollinia of Acerates longifolia. Fig. 5, Sketch of face of *Cerceris bicornuta* Guér., with pollinia of Acerates longifolia. Fig. 6, Pollinia of *Acerates viridiflora* Ell.; one in stigmatic chamber with tubes emitted. Fig. 7, Corpusculum of same, "spiked" and displaced by caudicle of inserted pollinium.

The "Curl" of Peach Leaves: a study of the abnormal structure induced by Exoascus deformans.[1]

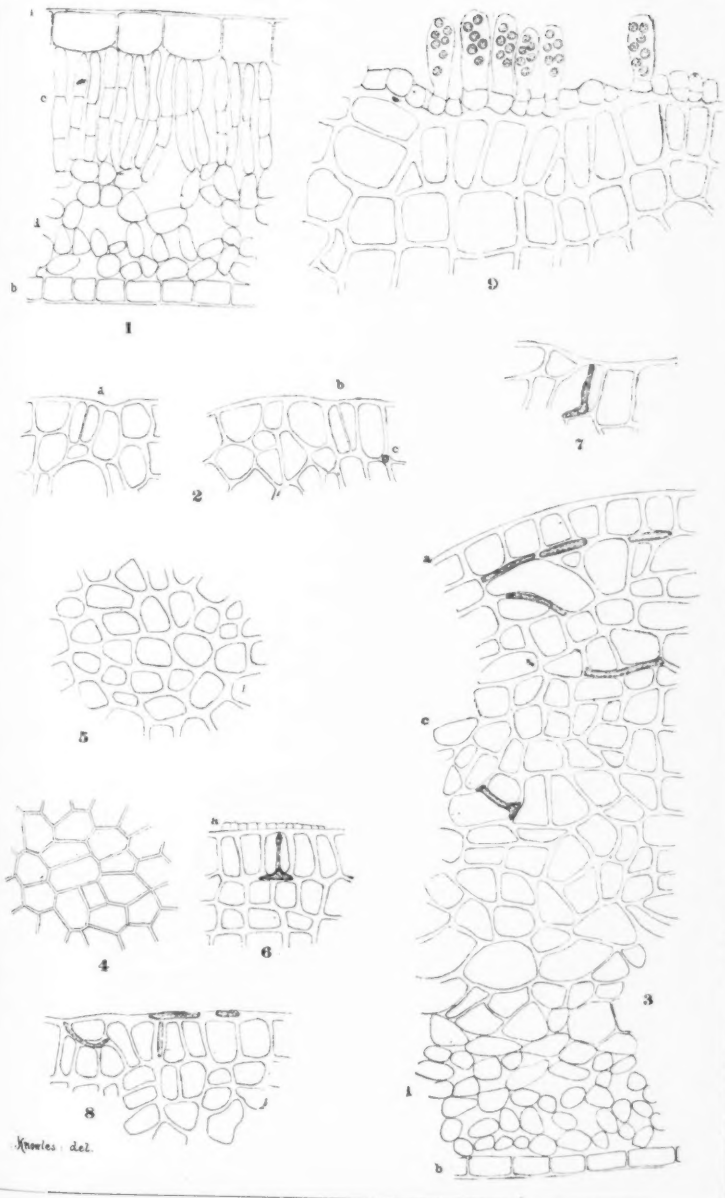
ETTA L. KNOWLES.

(WITH PLATE XIII.)

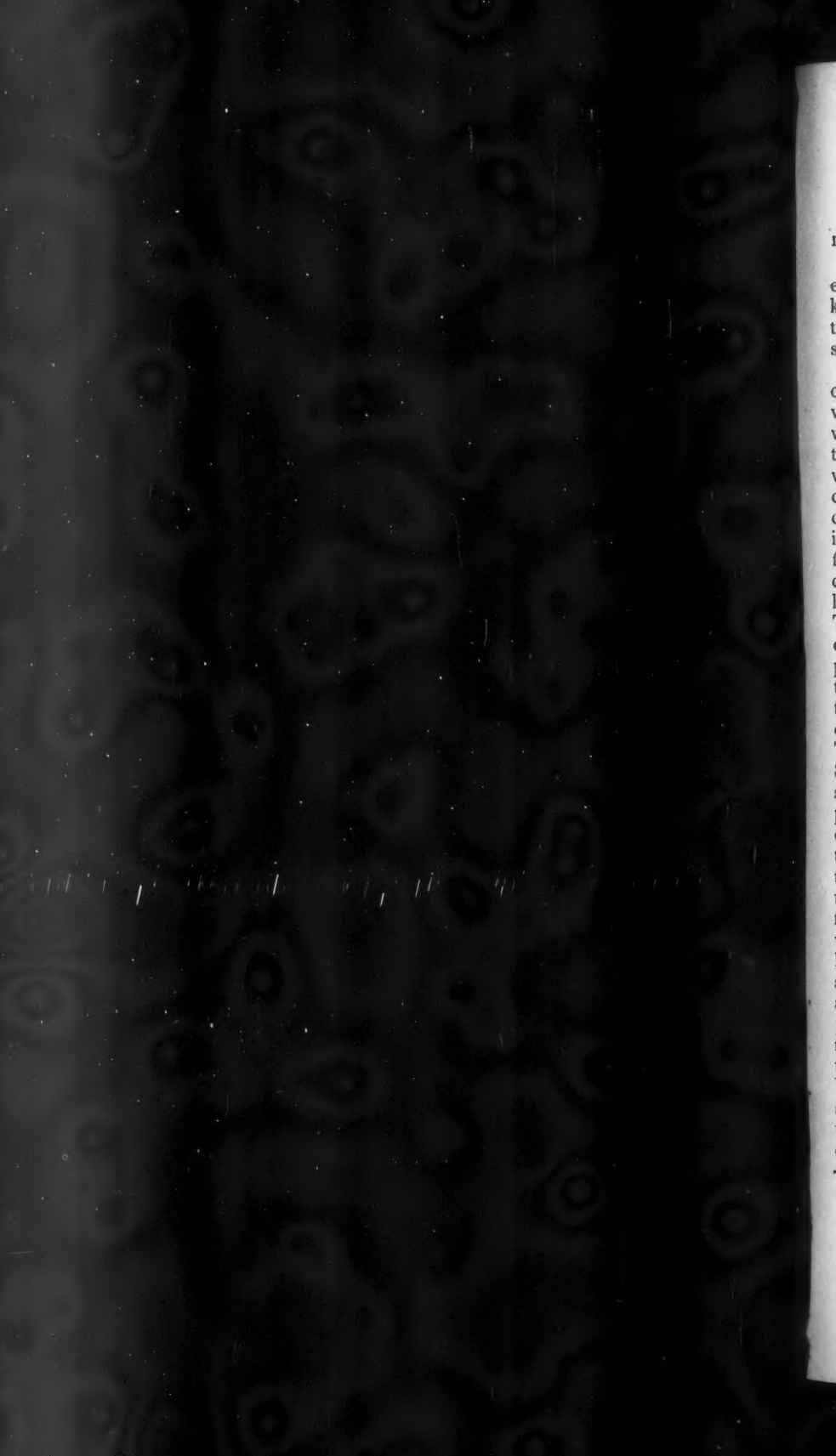
The fungus which causes the disease of peach leaves, known as "the curl," appears very soon after the leaf unfolds. The following observations were made from alcoholic material gathered May 30, and June 8, 1887. The fungus continued to make its appearance on growing leaves up to the time of concluding this work, at the end of June, but was less abundant at that time than early in the month.

A study of the structure of the normal leaf was first made to serve as a basis of comparison with that of the diseased leaf. The drawings were all made with the camera. Fig. 1 represents a cross section of a healthy peach leaf, *a* being the upper and *b* the lower surface. The epidermis consists of a single layer of cells, the outer walls of which are covered with a very thin, delicate cuticle. The epidermal cells of the two surfaces differ considerably in shape and size, as shown in the figure. Next to the epidermal layer of the lower surface are ordinary parenchymatous cells, thin-walled, irregular in shape and arrangement, and with large intercellular spaces. Beneath the epidermis of the upper surface are from two to three layers of palisade cells, likewise thin-walled, but with smaller intercellular spaces. The cells are filled with granular protoplasm in which are round masses of chlorophyll. On the under surface are numerous stomata. Both

[1] Contributions from the Botanical Laboratory of the University of Michigan, 1887



KNOWLES on PEACH CURL.



epidermal surfaces are smooth, without appendages of any kind. As the fibro-vascular bundles are little affected in the diseased leaf it is not thought necessary to describe their structure.

The fungus was found to be fully matured at the first date of gathering. It makes its appearance very early in the development of the leaf, and in most cases seems to start somewhere in the upper half, as a small puff or swelling in the tissue. This spreads until in many cases it affects nearly the whole leaf. The fungus stimulates the growth of the parenchyma, giving rise to cell-division and thus to a greatly increased area of the surface. Fig. 2 shows two cells, *a* and *b*, in process of division. Attention was called to them by the fact that they were full of protoplasm while the surrounding cells were empty or nearly so. At first glance each looked like a single cell, but on focusing a septum was very plain. The fibro-vascular bundles or veins are acted upon to some extent but do not keep pace with the increased growth of the parenchymatous portion, hence they act as threads on which the other part of the leaf is "gathered," forming the puffs or folds already described. In many cases the leaf is nearly or quite doubled in width and is greatly increased in thickness. The color is a grayish-white when the fungus is mature. Soon after the mature state is reached the leaf becomes shriveled up, turns dark brown and drops off. In the latter part of June the leaves that were infected turned red or orange, looking like leaves in autumn. Taking a cross section of the abnormal leaf the structure was found to be very much altered, as may be seen in fig. 3, in which *a* is the upper and *b* the lower surface, corresponding to *a* and *b* in fig. 1. The epidermal cells have changed in form and their walls are much thicker. The long, narrow palisade cells have swollen and divided until they have the appearance shown in the figure at *c*. The intercellular spaces have disappeared and the cells are nearly or quite empty. The lower part of the leaf is not so much changed, the mycelium being most abundant in the upper portion. The fruiting portion of the fungus is not found on the lower surface of the leaf at all. Winter's statement[2] that the asci break through the lower side of the leaf does not hold good for the peach. Taking thin sections of the normal leaf, parallel to the surface, the epidermal cells were found to be as represented in fig. 4,

[2]Kryptogamen-Flora, Ascomycetes, p. 6.

thin-walled, acutely-angled, polygonal cells. Upon examining a corresponding section taken from an abnormal leaf the change which had taken place was found to be as shown in fig. 5. The acute angles had disappeared in a great measure and the cell walls were much thicker.

The mycelium of the fungus, Exoascus deformans, which causes these changes, is septate, variable in thickness, branches irregularly, runs between the cells, and is filled with granular protoplasm in which there is considerable oil. No haustoria were observed. There was some difficulty in finding mycelium running to the surface, but after numerous sections, various cases were observed in which it was seen to pass directly through the epidermal cells, as shown in figs. 6 and 7, or between them as represented in fig. 8. Fig. 8 also shows where mycelium has passed to the surface, and there run for some distance under the cuticle. The same thing was noticed in several sections not figured. Having thus penetrated the cells of the epidermis, the mycelium forms numerous branches, the ends of which enlarge, and after being separated by a septum, form the asci with spores represented in fig. 9. As they grow they push up the cuticle and finally break through it. The protoplasm contained in the asci rounds off into spores, six or seven usually being found and in some cases eight in each ascus.

To sum up briefly the action of the fungus on the leaf:

1. A marked increase in width and thickness accompanied by great distortion.

2. Great multiplication of cells, particularly of the palisade cells and immediately adjacent parenchyma, by cell division.

3. Thickening of the cell walls and disappearance of the intercellular spaces.

4. Diminution of cell contents which often are almost or wholly wanting.

EXPLANATION OF PLATE XIII.—Fig. 1, Cross section of a healthy leaf, *a* the upper, *b* the lower surface, *c* palisade, *d* spongy parenchyma. Fig. 2, Two sections of the upper surface of an abnormal leaf, *a*, *b* cells in process of division, *c* cross section of a hypha. Fig. 3, Cross section of an abnormal leaf showing mycelium in different forms; *a* upper, *b* lower surface, *c* palisade, *d* spongy parenchyma. Fig. 4, Section of the upper epidermis of a healthy leaf, parallel to the surface. Fig. 5, Corresponding section of an abnormal leaf. Figs. 6, 7, 8 and 9, cross sections of the upper surface of abnormal leaves; *a*, in fig 6, young asci. Figs. 1—8 × 140. Fig. 9 × 200.

An excursion to the Platte.

HARVEY THOMSON.

I have thought an account of a botanical excursion to the Platte river region of Central and Western Nebraska might be of interest to botanists. I had been planning for some time to make a trip from Hastings to the Platte valley, but failed to make arrangements to go until May 21. The excursion was preceded by a preliminary trip May 14 for the purpose of selecting good botanizing grounds; also, another hasty trip was made to a point some three miles further up the river May 24. In all, points extending some four or five miles along the river were visited, and the list of plants may include some found in each or all of the trips.

Sixteen of us started early in the morning of May 21 for a fifteen-mile drive over the prairie to the valley. Keeping directly north along the railroad toward Grand Island, where the land was cultivated, nothing of interest was found, except the occasional appearance of Taraxacum officinale about dwellings. This plant, so common everywhere in the East, was never seen here until within the last two or three years, but from its present growth it promises to become quite a pest to farmers. Six miles north of Hastings we turned to the west, and, going some five miles, found the open, uncultivated prairie, and the typical flora growing upon a sod which had never been disturbed by man, the only sign of civilization being a slightly broken wagon road across the prairie, and at long intervals a small farm-house. Sometimes these were built of sod or were the much talked of "dug-outs." The first settlers in this country took "claims" down in the river valley, thinking this to be the best land, and when railroads were built the second group of settlers felt that they must be within hearing distance of the cars or they were entirely out of the pale of civilization; so that it is still possible to find within a few miles of a city of twelve thousand inhabitants soil owned by speculators which is still covered by the virgin sod. Out upon this prairie we found Viola delphinifolia and Callirrhoe alcæoides. Heretofore C. involucrata has been most abundant here, and has received the name of "Platte Valley rose" from the people living along the Platte. This year I have been unable to find a single specimen, and there has been but one brought in by my students, while C. alcæoides is abundant everywhere.

Oxalis violacea, with its purple flowers, almost covered the ground in places on the prairie. Last year O. corniculata outnumbered O. violacea, while this year it is very scarce, as I have only seen a very few specimens. There were also found in great abundance Amorpha canescens (just beginning to bud nicely), Astragalus caryocarpus, Oxytropis Lamberti, Antennaria plantaginifolia (mostly in fruit), Senecio aureus var. Balsamitæ, and Troximon cuspidatum. Astragalus caryocarpus, with its large, nut-shaped fruit, grows everywhere over the prairies. Its flowers vary in color from dark purple to almost white, not one in twenty of which could be termed "violet." The people call the fruit "buffalo bean," and its great size and beauty is a thing of which they like to boast. Among the rarer plants seen on the prairie were Malvastrum coccineum, Rhus Toxicodendron, Lathyrus polymorphus, Œnothera serrulata, Gaura coccinea, Pentstemon albidus, and Sisyrinchium mucronatum. Lathyrus polymorphus, I believe, has not been reported as being found this far north, at least in the "Flora of the Rocky Mountains," but I have seen it several times in favorable localities.

After some time spent upon the prairie we pushed on to the border-hills of the Platte valley. Here we stopped for another search in the ravines and along hill-sides. In addition to several of the plants already mentioned, we found Ranunculus rhomboideus, Psoralea lanceolata, Aplopappus spinulosus (just beginning to bloom), Lithospermum hirtum, and Veronica peregrina.

The inner man now calling for some new supplies, we drove down into the valley proper and camped out, the ladies of the party spreading lunch upon as beautiful a piece of velvety lawn as one will see anywhere. The Platte valley is here a mile and a half or two miles wide and bordered by low, sandy hills. Next to the Missouri, the Platte river is, perhaps, the muddiest, and changes its bed oftener than any other river in the world. Generally, however, it flows near the middle of the valley, but its banks are always crumbling and falling in and the bed of the river is full of islands and sand-bars. The cause of this changing is found in the very loose, sandy soil and the swiftness of the water. This, in turn, makes it a good transporter of plants, as we saw to our delight.

Lunch being over, part were detailed as drivers, while the rest of us spread out over the valley to take in whatever

could be found in the way of plants. In this way we moved up the river. It did not take long to discover that we were in a flora differing from that of the prairie almost as much as if it had been on the other side of a continent. Viola delphinifolia, Callirrhoe alcæoides, Oxytropis Lamberti, and Senecio aureus, var. Balsamitæ occurred occasionally, while Sisyrinchium mucronatum, which was somewhat rare on the prairie, almost covered the river bottom. Everything else was new. In the water of a slough we found Ranunculus multifidus, Erigeron Philadelphicus. Viola palmata, var. cucullata, and Lithospermum angustifolium were occasionally found, while Salix longifolia lined the river bank in places. Among the best "finds" made were Crepis runcinata[1] and Plantago eriopoda, both of which seem to belong farther west, at least they have not been found east of Colorado. Cypripedium parviflorum, which is said to be quite rare in this state, was very abundant in one place.

At one point along the river several acres of the bottom were found very thickly dotted with Cypripedium candidum. Local botanists claim that this is the only place in the state where it is found. Perhaps this is true, as it is no doubt very rare. The plant, however, whose presence here surprised me most, was Lysimachia thyrsiflora. This is, or has always been considered, a distinctly eastern species, although I have a specimen in my herbarium from Iowa, as well as from the east. This is, I think, the first time it was ever found so far west. More abundant than anything else in the valley was Hypoxis erecta, the ground being thickly set all over with its yellow, star-like flowers. Among other things found were Smilacina stellata, Tradescantia Virginica, Eleocharis palustris, Carex tetanica, C. filiformis, var. latifolia, C. stricta, C. straminea, Equisetum arvense, and E. lævigatum.

The study of this flora becomes exceedingly interesting, because, with a large river running almost directly east, we have a natural channel for the distribution of plants, and here we have plants from the extreme east and west. With two large and very swiftly flowing rivers rising in the mountains west of us and flowing to the east, and several lines of railroads entering the state from different directions, one may expect to find a very large and diverse flora and ought not to be surprised if strays from almost any part of the country should be found here.

[1] This species is reported on the prairies of Iowa and the Red River valley of Minnesota.—EDS.]

BRIEFER ARTICLES.

Botanical Papers before the American Association.—The papers read before the American Association for the Advancement of Science at the New York meeting, which are of interest to botanists, are as follows:

W. J. Beal, Comparison of the epidermal system of different plants.

W. J. Beal and C. E. St. John, Study of the hairs in Silphium perfoliatum and Dipsacus laciniatus in relation to insects.

R. P. Bigelow, On the structure of the frond of Champia parvula.

N. L. Britton, Notes on the flora of the Kittatinny mountains.

J. M. Coulter and J. N. Rose, Development of the Umbellifer fruit.

A. A. Crozier, Methods of branching in the fibro-vascular system of plants.

W. G. Farlow, Apical growth in Fucus; also Æcidium on Juniperus Virginiana.

W. M. Fontaine, The flora of the Potomac formation in Virginia.

W. M McMurtrie, Note on the chemistry of germination; also Note on absorption of nitrogenous nutriment by the roots of plants.

J. S. Newberry, Flora of the Amboy clays.

F S. Pease, Honey plant oil.

Mrs. F. S Pease, The honey plant.

H. H. Rusby, The cultivated Cinchonas of Bolivia.

J. Schrenk, On the histology of the vegetative organs of Brasenia peltata.

A. B. Seymour, Character of the injuries produced by parasitic fungi upon their host plants.

Miss Effie A. Southworth, Notes on Catalpa leaf spot disease.

Sereno Watson, Some notes on American roses.

This list does not contain as many papers as were presented by the zoologists of the Association. It was the plan to have botanical papers read before the Section of Biology in the morning and zoological papers in the afternoon, but the plan was strictly carried out only on Thursday, the first day of the meeting on which papers were read, while on Friday, the second day of reading papers, no botanical subjects were put on the programme. If, however, the botanists did not do their full duty in maintaining an equilibrium between the two sides of the biological body, they at least furnished good material for their portion.

Dr. Beal's paper on the hairs in Silphium and Dipsacus, in which he took the ground that they had no special physiological significance, and that the water of the cups was not excreted by the plant but supplied by rains, was illustrated by charts and specimens, and led to an extended discussion, in which Messrs. Macloskie, Rusby, Schrenk, A. J. Cook Eccles, and others took part. Some of the speakers were disinclined to agree with the author's conclusions, and the query of what could have caused the development of the hairs in advance of their usefulness to the plant received considerable attention.

The paper by Mr. Bigelow, illustrated by enlarged drawings, cleared up the various conflicting views regarding the apical growth of the sea-

weed, *Champia parvula* Harv., and established the interesting fact that there are five cells at the apex of the frond, instead of one as is usual in other plants. The paper will be published in the Proceedings of the American Academy.

Dr. Britton's paper has already appeared in the August number of the *Bulletin of the Torrey Club*. It dealt with the correspondence of the floral and lithological features in certain parts of New Jersey, especially the occurrence on the Kittatinny mountains of plants whose ordinary habitat is in the sandy soil near the sea-shore. The paper was commended by Prof. T. C. Porter, who spoke of his own studies in the same line, which he hoped to publish after a time.

In the absence of Prof. Coulter his paper on Umbellifer fruits was read by Dr. Beal. The paper did not admit of discussion on account of its technical character; it will be published in this journal.

Dr. Farlow spoke of the confusion which has arisen regarding the apical growth in Fucus, illustrating his remarks with blackboard sketches. Investigators have been inclined to think that the growth proceeded from more than one apical cell. This was shown to be untrue, and what does take place was explained, together with the reasons that led other observers to different views.

The outline of Dr. Newberry's remarks on the flora of the Amboy clays was published some time since in the *Bulletin of the Torrey Club*.

The two papers on the honey plant were read for the authors. The plant, Echinops sphærocephalus, thistle-like in appearance, growing four to five feet high, has been discovered to be of more than usual value for bees. It is hardy at Buffalo, N. Y. The seeds, about the size and form of rye, yield more oil than linseed, being as much as four and a half ounces to the pound when crudely expressed. The residue left after removing the oil is very bitter like quinine, but the active principle has not been examined. Samples of the plant and its products were exhibited. The paper was discussed by Messrs. Morong, Britton, Claypole, and Mrs. Wolcott, especially as to the literature of the subject and the possibility of the plant becoming a troublesome weed if allowed to escape from cultivation.

Dr. Schrenk's paper on the minute structure of Brasenia was a long and able account of an interesting investigation. It was illustrated by growing plants, sections under the microscope, and enlarged drawings.

Proterogyny in Datura meteloides.—I have been cultivating this species for ornament, and by accident discovered the peculiar way in which the stigma is in a position in which it may be fertilized before the pollen of its own flower is shed.

As is well known the corolla, in æstivation, is plicate-convolute or supervolute, and opens in the evening twilight and begins to close and droop shortly after sunrise the following morning. From twenty-

four to thirty-six hours before the corolla opens the stigma begins to peep out through the center of the convoluted folds. It gradually protrudes farther until during the last afternoon it is from one-half to three-fourths inch beyond the highest point of the closed corolla. It is thus ready to be fertilized by the pollen of the flowers that are open the evening before its own opens. I have examined the other two species of Datura that grow here, but find no such contrivance for cross-fertilization.

J. SCHNECK, *Mt. Carmel, Ill.*, Aug. 22, 1887.

Entertainment of the Botanists in New York.—Nothing that could reasonably have been done to add to the profitable enjoyment of the botanists of the Association during its August meeting was omitted, and the execution of the carefully devised plans was accomplished without break. This result was brought about by the efforts of the Torrey Botanical Club, and thanks are due to no individuals more than to Dr. and Mrs. Britton.

Upon arrival the botanists found a room set apart for the Club, where they registered, and received their distinctive badges of yellow silk and a programme of the botanical announcements for the week.

A reception by the Torrey Club was given the Club of the Association on Friday evening in the commodious hall of the Columbia Library, which afforded a good opportunity for the exchange of courtesies and the renewal and promotion of acquaintanceship. A rich collation added to the pleasure of the evening.

No feature of the whole meeting was more enjoyable than the excursion to Sandy Hook, which took place Monday afternoon, and in which the entomologists joined with the botanists. Morning showers and a lowering sky threatened to repeat the Point Abino experience of last year; but the sky, the atmosphere and the temperature combined in really producing the most admirable of weather. A trim and cozy harbor steamer, well supplied with refreshments, made the hour's ride especially comfortable.

Sandy Hook is a low stretch of sandy sea-coast, with a rather meager flora of grass and herbaceous plants, with clumps of shrubs and low trees, and still fewer representatives of mosses, algæ, lichens and fungi. The locality was chiefly interesting for its peculiar sea-side character, and was in marked contrast to the rich and varied floras of the localities the club has usually visited. Among the plants which excited the most interest were the beach plum, Prunus pumila, with its black knot fungus: Senecio cineraria, the dusty miller of the gardens, with the habit of a native plant; a broad-jointed Opuntia, and the beautiful flowers of a Sabbatia, among the higher plants. Among lower plants, the abundance of a smut on the inflorescence of Cyperus Grayi attracted attention; a lichen gave a carpet-like growth upon the sandy soil in some places, and a single Geaster stood for the larger fungi.

During the return trip happy and instructive remarks were made upon the events and collections of the day by Mr. Morong, who acted as chairman, Judge Day, Mr. Canby, Dr. Beal, Mr. W. H. Seaman, Prof. Claypole, Dr. Britton, Dr. Arthur, Prof. Spalding, Mr. Jesup, Miss Steele, Mrs. Britton, Mrs. Wolcott, Mr. Fernow, Prof. Lazenby, Prof. Scribner, Dr. Allen and others of the botanical party, and several of the entomologists. The presence of the son and grandson of Dr. Torrey, although neither is a botanist, brought the name of the venerated botanist into stronger association with the place than anything had previously done. Altogether, the club has not had a more delightful and memorable excursion than the one to Sandy Hook.

The Torrey Club added to the pleasure of the visiting botanists by opening their comfortable library and herbarium room, and affording every facility for consulting books and specimens. It was a spot that had many charms, and was much visited. The generosity and forethought of the club toward their guests were also shown in the provision of a set of sixty-three species of the most interesting of the flowering plants of the vicinity, well mounted and labeled, which they were at liberty to take away with them, forming valuable souvenirs of the meeting.

The New York gathering will be remembered as a thoroughly delightful and profitable one.

Dispersion of seeds of Euphorbia marginata Pursh.—This beautiful species of spurge, which has within the last twelve years been first cultivated in this vicinity, under the common name of "Snow on the Mountain," or "Mountain of Snow," proves to be quite interesting as well as ornamental. It has escaped, and has gone a good distance from the flower-beds and gardens, and has made itself at home in almost all parts of our country along the roadsides and near farm-houses. During September, 1886, I had a bouquet placed on my office table in which were several sprays of this species. While otherwise engaged I heard a sudden tick, as if some one had thrown a small gravel against the window-pane. This was repeated several times, and I stepped outside the room to look for the rascally urchin, but failed to find him. Afterward I discovered that the sound was caused by the sudden bursting of the seed-pods of the specimens of this plant which were in the bouquet. I kept this species under observation more or less constantly during the remainder of last season, and have learned the following facts about it:

The stiped ovary arises at first above the involucre, but as soon as the stipe is long enough to reach over the involucre it droops down over the outside, and thus remains inverted until the fruit is fully developed, which usually requires nearly one week. As the capsule begins to dry and the seeds to ripen it resumes the erect or vertical position. This last movement of near 180° is generally completed in less than one day. It is now ready to burst and scatter the seed. As it thus stands it consists

of a stipe near three-fourths of an inch long, on the top of which is a three-celled, obtusely triangular capsule. Each cell contains a pitted spherical seed, which is a little larger than that of white mustard. The covering of each seed consists of two equal halves, which unite and form a complete cell, except along the inner or central border. Here each half is joined to the neighboring cell in such a manner as to leave a deficiency, thus forming a central cavity which opens into each of the three cells. Passing up through this central cavity is the continuation of the stipe, which is triangular and membranaceous, and so shaped as to fill up the deficiencies where the two halves fail to unite, thus completing each of the three cells. It will thus be seen that the line of dehiscence is much shorter on the inner border of the cell than on the outer, and that the two valves do not touch one another at all at the central part of the inner line of dehiscence.

As the capsule ripens and the stipe assumes the erect position the green color gradually fades and the seams commence to separate. Suddenly all of the six valves contract upon themselves at the same time, thus completely detaching themselves and scattering the three seeds upward and outward. Quite a number of seeds were thrown on to a shelf which was ten inches higher than the top of the bouquet and nearly a foot away from it. The greatest distance which a seed was thrown was nine feet, measured by a line drawn direct from the flower to the spot where the seed struck the ground. The seed had traveled in an upward curve, and had probably made a journey of twelve feet. The sound which was produced at dehiscence was heard sixty-five feet away, in the open air, and nearly one hundred in a room. In looking over such botanical literature as I have at hand, I find that on page 20 of the BOTANICAL GAZETTE for 1880 Prof. W. C. White reports that E. E. White had observed a similar habit in *Euphorbia corollata* L., the report being loud enough to be heard across an ordinary room. J. SCHNECK, *Mt. Carmel, Ill.*

The A. A. A. S. Botanical Club at New York.—The Botanical Club of the A. A. A. S. held its first meeting for this year Thursday, August 11, in the law building of Columbia College. In the absence of the chairman, Mr. M. S. Bebb, the Club was called to order by the secretary, Mrs. E. G. Britton, and Mr. Thomas Morong was elected chairman for the present meeting. About fifty were in attendance, and although the absence of some of the most active members was noted with regret, the Club went promptly to work with its accustomed vigor.

The first paper was read by Dr. W. J. Beal, on "The Root-stocks of Leersia and Muhlenbergia." This was followed by one on the "Dehiscence of the Sporangium of Adiantum pedatum," by Florence May Lyon, read in the author's absence by Prof. V. M. Spalding. Mrs. Britton then presented a list of plants of the vicinity of New York, collected by a committee of the Torrey Botanical Club, specimens of which were placed at the disposal of those present. The list includes a number that are of

special interest as regards their distribution, and others, such as Cyperus Torreyi, for example, are new species.

Dr. George Vasey presented a written statement setting forth the claims of the National Herbarium, and a committee was appointed to take the subject under consideration with reference to some action on the part of the Club.

Friday, August 12, about sixty were present. The Club was called to order by the chairman. The committee appointed Thursday was called upon to report through Dr. Vasey, but as the committee had had no formal meeting, and was not ready to report, it was agreed to appoint a committee to consider the subject further, and act in behalf of the Club. This committee as appointed by the chair consists of Messrs. Asa Gray, W. M. Canby, and W. J. Beal.

A communication from Prof. E. S. Bastin, of the Chicago College of Pharmacy, was read, suggesting the desirability of concerted action on the part of botanists, and division of labor with reference to problems still to be worked out.

A letter from Prof. D. S. Kellicott, of Buffalo, was read, raising inquiries concerning the crackling sound of Utricularia vulgaris when taken from the water. Mr. Day, of Buffalo, followed with a few remarks. Prof. C. E. Bessey sent his greetings to the club, with regrets at being obliged to be absent.

A paper was next read by Prof. E. W. Claypole on "Some of the secondary results of pollination," which was followed by rather animated discussions on the part of a number of members.

Mr. A. A. Crozier then brought up the subject of the definition of some common botanical words, and Dr. N. L. Britton called attention to three new species of Cyperus that had come to light since his revision of the North America species of that genus. Mrs. H. L. T. Wolcott exhibited a specimen of yellow-fruited choke cherry, from Massachusetts, near Boston.

Monday, August 15, the Club was called to order by the chairman, Mr. Morong, over fifty being present. Committees on resolutions and nominations were appointed, the former consisting of Messrs. Day, Canby and Crozier, the latter of Messrs. Beal and Britton, and Mrs. Wolcott. The chairman suggested the advisability of securing a special room for the Club next year, to avoid annoying interruptions caused by the same room being used by the biological section.

The first paper was read by Mr. W. M. Canby, on the recently discovered fruit of Darbeya umbellulata, a species first collected at Milledgeville, Ga., and described by Dr. Gray in *Silliman's Journal*, in 1846. The plant belongs to the Santalaceæ, and has been referred by Bentham and Hooker to Buckleya. There are some characters that indicate a very close relationship to Comandra, but the new specimens tend to confirm Dr. Gray's opinion, that it is distinct from either genus.

Mr. A. A. Crozier illustrated a method of drying plants by means of an oven constructed for the purpose.

A letter was read from W. F. Moffat with reference to the proposed location in Lincoln Park, Chicago, of a statue of Linnæus, an exact counterpart of the one recently erected at Stockholm. The estimated cost is $30,000.

Mr. Morong introduced the subject of a national botanical exchange, on the plan of similar exchanges in Europe. A good deal of interest was manifested, and remarks were made by Messrs. Crozier, Beal, Britton, Fernow, Rusby and others. A committee consisting of Messrs. Vasey, Britton, Watson, Morong and Halsted was appointed with power to act for the Club, and report through the botanical magazines.

Mr. F. L. Scribner reported an interesting observation upon the ejection of the ascospores of Physalospora Bidwellii. Grapes affected with the black rot were gathered at Vineland, N. J., last year, and placed in a damp atmosphere, when after eighteen to forty-eight hours it was found that the ascospores had been ejected with some force and thrown against the walls of the chamber. Mr. Scribner also reported the spread of the black rot in France. The disease appeared there two years ago, and is now rapidly extending through the southwestern part of that country.

Tuesday, August 16. The nominating committee reported David F. Day as chairman, and Volney M. Spalding as secretary for the ensuing year. The committee on resolutions then reported resolutions expressing the great obligations of the Club to the members of the Torrey Botanical Club.

Prof. George Macloskie spoke of the hairs of watermelon seed as packed transversely, and when moistened extending and showing zigzag branching. Lists of the desiderata of the herbarium of the Department of Agriculture were distributed. Mrs. E. G. Britton spoke of the second blooming of Wistaria this year on Staten Island. The first flowers are seldom fertilized owing to the visits of the bumblebees, while the late flowers are visited in the normal way by another bee.

Mr. Morong asked if Typha angustifolia is always confined to the vicinity of the seashore, and T. latifolia inland. He invited observations on the distinguishing characters of these two species. He also asked for observations on Sparganium.

Mr. Sereno Watson said that Arabis petræa of the Manual must be dropped, as it is *Sisymbrium humile* Meyer (BOT. GAZETTE, xii. 200).

Mrs. M. L. Moody read a paper describing the discovery of Epipactis latifolia near Buffalo.

Mr. F. L. Scribner spoke of the remarkable abundance of Cercospora viticola at Fayetteville, N. C.

The Club then adjourned to meet next August at Cleveland.

OPEN LETTERS.

Relation of moisture to plant diseases.

The object of this note is that of inquiry, especially as to the value of the following opinions and observations:

It is the prevailing opinion that wet weather is favorable to the growth of parasitic fungi, and this is no doubt true in some cases at least. The spring of 1882 was a rainy one in Illinois, and a large number of Peronosporæ were collected. This year a large amount of rain has fallen in New England during July and August, and Uredineæ and Erysipheæ are less abundant than in dryer seasons. In dry autumns like that of 1886 in Central Illinois, fungi of these two groups are exceedingly plentiful. Water plants have few parasites, and plants of wet places less than those growing upon common soil. A. B. SEYMOUR.

Cambridge, Mass.

Bees mutilating flowers.

In the May number of the GAZETTE, in a note on Mertensia, Dr. J. Schneck suggests that the habits of bees to mutilate the corollas of flowers, in order to get at the honey, may be general. Appended are some notes on the subject.

Aquilegia vulgaris L. is mutilated by humblebees. The insects puncture the spur a little above the bulb at the end.

Lonicera parviflora Lam. is punctured just above the calyx.

Weigela (Diervilla, cult. specs.), punctured by humblebees. Honey bees enter the tube.

Orchis spectabilis L. Slits made in lower end of spur.

Aquilegia Canadensis L. Spurs punctured just above bulb.

Mertensia Virginica DC. In May number of BOTANICAL GAZETTE Mr. Schneck mentions Mertensia as being mutilated. A few days after seeing the note I happened to find a patch of that plant and watched the bees at work. They generally punctured the tube, but occasionally a bee would light on the mouth of a tube, insert his head, and then by a sudden movement of the wings cause the honey to drop down upon his head and then suck it up through his proboscis.

Lonicera grata Ait. Reported by Nathan Banks from Roslyn, L. I.

Tropæolum major. Reported by Nathan Banks. "Often 2-5 punctures in the same spur."

Impatiens fulva Nutt. Sometimes the end of the spur is bitten off.

Linaria vulgaris Mill. Slits are made in the spur.

Poughkeepsie, N. Y. GILBERT VAN INGEN.

CURRENT LITERATURE.

Revision of North American Linaceæ. By William Trelease. From Trans. St. Louis Acad Sci., Vol. v., no. 1, pp. 1–20, with 2 plates.

Twenty-one species are described, the two plates representing the fruit of the genus and the petals and filaments of the section Hesperolinon. L. perenne of American botanists becomes *L. Lewisii* Pursh. L. Floridanum is brought to specific rank from a variety of L. Virginianum.

Our species are all clearly endemic with one exception, L. Lewisii. The European forms of L. perenne are heterogone-dimorphic and self-sterile, while the American representative is not heterogone. "It appears, therefore, that forms of a single species, originally distributed over the northern portion of both continents, have in the course of time differentiated so far as to acquire heterogeny in the Old World, or lose it in the New—the latter appearing more probable."

Contributions to American Botany, XIV. By Sereno Watson. From Proc. Am. Acad., xxii., pp. 396–481.

Most of this contribution is given to the enumeration of plants collected by Dr. E. Palmer in Mexico in 1886. It contains the usual percentage of new species that always rewards the labors of the diligent collector in Mexico. This collection was made about Guadalajara, state of Jalisco, as a center, and of all the localities, Tequila, a deep volcanic depression twenty miles northwest of Guadalajara, yielded the most novelties. Of the 675 species enumerated 120 are new, 40 new Polypetalæ by Watson, 45 Gamopetalæ by Gray, 30 Apetalæ and Monocotyledons by Watson, 2 Grasses by Vasey, and 3 Ferns by Eaton. A new genus of Asclepiadaceæ is Mellichampia, dedicated to our well-known southern botanist; Corythea is a new genus of Euphorbiaceæ, and Prochnyanthes a new genus of Agaveæ. In the second part of the contribution are descriptions of 44 new species from various localities, chiefly western. Arabis Drummondii of the Atlantic region all becomes the new species *A. confinis* Watson. True A. Drummondii is confined to the western mountains. In recasting this genus Mr. Watson has found it necessary to propose 6 new species of Arabis, all belonging to the section Turritis, and all western. Podistera is proposed as a new genus of Umbelliferæ, nearly related to Pimpinella, its type being Cymopterus (?) Nevadensis. Peucedanum graveolens of Bot. King's Exp. becomes P. Kingii, owing to prior publication of the former name in the Genera Plantarum. It is also *Seseli Nuttallii* Gray, in large part. *Quercus Sadleriana* R. Brown finds a place among the western oaks, and *Q. Breweri* Eng. is replaced by the earlier name of *Q. Œrstedtiana* R. Brown.

Fresh-water Algæ of the United States (exclusive of the Diatomaceæ), complemental to "Desmids of the United States." By Rev. Francis Wolle. Bethlehem, 1887. Roy. 8°. 2 vol., pp. 364, 151 plates.

This work has been long expected, and meets with a warm welcome. No part of the American flora is so much in need of careful systematic treatment as the algæ. The work of Dr. Wood, long since out of print, was unhandy in form and confessedly incomplete, but has been the only work to do service as a manual up to the present time.

The excellent volume on the "Desmids of the United States," issued some time ago by the same author, has led to the expectation of an equally satisfactory treatment of the remaining non-siliceous fresh-water

algæ. In the matter of characterization of species, illustrations, which are abundant and excellent, and general typographical features, the expectation is realized; but in the discussion of imperfectly understood forms and in classification and arrangement, the work is disappointing. The preface, the introduction, and paragraphs here and there through the work, altogether forming many pages, are devoted to elucidating the author's views of polymorphism among algæ, and the consequent unreliability of descriptions of many so-called species as representing specific and stable forms. The theme is evidently a hobby, and so thoroughly permeates the work as to leave an uncomfortable feeling in the mind of the student that there is great and discouraging uncertainty regarding the stability and limits of species among fresh-water algæ, especially of the simpler forms. We regard the discussion as in the main foreign to the purposes of the work and as interfering with its usefulness.

The classification used does not commend itself for either philosophical arrangement or serviceableness. It is not explained; and there is no general key or analytical table to guide the student. A few genera are provided with an outline or key to the species adapted from other writers, notably of Œdogonium and Bulbochæte from Wittrock, Spirogyra from Petit, and Nostoc from Bornet and Thuret.

The volume closes with a good glossary and index, the latter inconveniently divided into two parts, one containing the names used and the other the synonyms.

Aside from imperfections, students will welcome these volumes as giving in connected and handy form the descriptions of our inland algæ, with copious and well drawn illustrations.

Practical Forestry, A treatise on the propagation, planting and cultivation, with a description and the botanical and common names of all the indigenous trees of the United States, both evergreen and deciduous, with notes on a large number of the most valuable exotic species. By Andrew S. Fuller. 12mo., pp. 300. New York: Orange Judd Co.

The above rather elaborate title-page sufficiently describes the scope of this book. The description of the species occupies the larger part (about 200 pages) and should be the most valuable part. But by reason of the faulty arrangement and the uneven descriptions its usefulness will be greatly lessened. The chief value of collected botanical descriptions of the arboreous plants of any region must be to enable one to determine the name of an unknown specimen. It is much more rarely that one knowing the name wants a description. How can the descriptive part of this book help any one while the genera are arranged *alphabetically* and without keys of any kind?

The author is evidently not a botanist, and when he unnecessarily undertakes to discuss synonymy he flounders in the mire of preference and convenience rather than stand upon the sometimes uncomfortable rock of priority. "The novice who desires to find an authority at once

unimpeachable and so thoroughly trustworthy that it may in all cases be quoted without fear" is warned that "even in such a simple matter [*sic*] as names of the different species of conifers, authors disagree!" Verily, they do. In the first part of the descriptive chapter the authorities for the names used are not given, though they appear in the index. Synonyms are given only in the index, and there *only below the accepted name*.

A queer set of chapter headings appear in the descriptive part. Thus chapter xv is headed "forest trees;" chapter xvi treats of "evergreen trees," including only Taxus, Torreya, Podocarpus, Dacridium and "Salisbury;" while chapter xvii is entitled "Coniferæ, or cone-bearing trees." What have the conifers done that they must be excluded from the forest trees, and not be allowed to associate with the evergreens?

Of course, the descriptive part is largely a compilation. The first eighty pages, containing chapters on raising trees from seed, budding and grafting, propagating by cutting, pruning, etc., has much useful information, though little that is new. With the author's plea for the preservation of our forests and the systematic establishment of new ones by the state or general government we are in hearty accord, and we sincerely hope that his book may do good in interesting farmers in such work, as it may come to their hands. But we can not get rid of the impression that the book before us was gotten up chiefly *to sell*. We do not therefore feel, as the author avows regarding Henderson's *Evergreens*, that we "can confidentially recommend it."

Vergleichende Anatomie der submersen Gewächse, by Dr. Heinrich Schenck. (Bibliotheca botanica, Heft 1.) Quarto, pp. 67, plates x. Cassel: Theodor Fischer. 1886.

This, the first memoir of a series under the general title "Bibliotheca botanica, Abhandlungen aus dem Gesammtgebiete der Botanik, herausgegeben von Dr. Oscar Uhlworm und Dr. F. H. Haenlein," is in every way worthy to lead the van. A publisher in this country who should undertake to put out such a collection of monographs would be thought mad by his fellows. Botanists are to be congratulated that there is one country and at least one publisher to do such work. Those who know Fischer's work need not be assured that both text and plates are worthy the *imprimatur*.

The memoir before us is a continuation of the author's earlier work, *Die Biologie der Wassergewächse*, and in it he traces the modifications of structure due to the different medium of growth and the consequent functional differences in various organs. The structure of leaves, stems and roots of over thirty species is compared in detail. Many observers have studied submerged plants but no one has ever before brought together the results into a complete comparative study. Some of the generalizations are highly interesting.

The leaves of most submerged plants show a tendency to become

slender and hair-like or grass-like, and show little differentiation in the parenchyma, which consists usually of very few layers. The epidermis generally contains chlorophyll bodies and lacks stomata. The vascular bundle is either single or accompanied by two other weakly developed strands. In the stem the vascular system is either reduced, as in Zannichellia, to a single bundle in which only the sieve-cells can be definitely distinguished, or it consists of several well-developed bundles coalescent, as in Potamogeton nitens. Between the two extremes there is every gradation. In the bundles one or more lysigenous passages occur which occupy the position of the large vessels, and at the nodes, where the stretching has been too small to destroy them, are fragments of these spiral or annular vessels.

As would be expected, the mechanical elements are but scantily developed. Hairs, crystal and tannin reservoirs are rare, while oil-glands, latex vessels and resin ducts are always wanting. The root system may be entirely suppressed as in Utricularia or fairly developed in more amphibious species.

This series of monographs, by reason of the elaborate work and the elegant illustrations which accompany it, should be in every working laboratory in this country.

Über die Gerbstoff- und Anthocyan-Behälter der Fumariaceen und einiger anderen Pflanzen. By Dr. W. Zopf, Privat-docent, University of Halle. (Bibliotheca botanica, Heft 2.) Quarto, pp. 40, 3 double colored plates. Cassel: Theodor Fischer. 1886.

This is the second paper of the same series. The colored plates are exquisitely done. We can not do better service to our readers than to give a brief abstract of Dr. Zopf's very careful work.

The relation of the Fumariaceæ to the Papaveraceæ suggested to the author that he examine them to discover, if possible, the structures corresponding to the latex vessels of the Poppy family. The analogous cells, which he designates as idioblasts, occur in all organs in the primary parenchyma, and also in those tissues which arise in the secondary thickening of the organs. The primary idioblasts arising from the primary meristem are elongated cells (2–10 mm.) without branches; the secondary, arising in the cambium of the vascular bundles, are at first of the same size as the cambium elements, but afterward elongate. In each at least one nucleus was found, and large quantities of tannic acid, commonly in the form of a clear, homogeneous and highly refractive solution, which may be colorless or dyed by a yellow or red anthocyan. Colorless or yellow idioblasts quickly become red when the organs containing them are exposed to light. Micro- and macro-chemical experiments indicate that the yellow pigment is converted into the red by acids, and it seems probable that the same action occurs in the living plant under the influence of light by the formation of organic acids. The yellow anthocyan appears to develop from a colorless chromogen. These pigments have a

definite relation to the tannin; but whether part of the tannin is converted into chromogen or whether the latter is formed new in the presence of the tannin is undetermined.

The plants investigated were Corydalis cava, C. pumila, C. Halleri, C. ochroleuca, C. lutea, Diclytra spectabilis, D. formosa, Adlumia cirrhosa, Fumaria officinalis, F. muralis, Parnassia palustris and Parietaria diffusa.

NOTES AND NEWS.

PROFESSOR C. E. BESSEY made a collecting trip to the Bad Lands and Black Hills of Dakota during vacation.

PROFESSOR L. M. UNDERWOOD, of Syracuse University, is making a two months' collecting trip through the Southern States.

THE FIFTH VOLUME of Saccardo's *Sylloge Fungorum*, devoted to the Agaricineæ, has been issued. It is a thick octavo of 1146 pages, price 72 francs.

DR. A. DE BARY has declined the call to Leipsic as Dr. Schenk's successor, and the professorship has been tendered to Dr. W. Pfeffer, of Tübingen.

DR. GEORG WINTER, editor of *Hedwigia*, and known to many American botanists by correspondence, died at Connewitz, near Leipzig, Germany, August 16, after a long and severe illness.

IN Dr. Farlow's address, printed in the August GAZETTE, an error occurs on page 180, which should be corrected. In the 13th line from the bottom the "not" should be stricken out, which materially alters the sense.

CHARLES S. PLUMB, of the New York Agricultural Experiment Station, and editor of *Agricultural Science*, has accepted the professorship of Agriculture, Botany and Entomology in the University of Tennessee, situated at Knoxville.

THE FIRST FASCIDE of volume 5 of the bulletin of the *Sociedade Broteriana*, bearing date of 1887, is chiefly devoted to a systematic description of the native orchids of Portugal by José d'A. Guimaraes. Thirty-nine species and nine genera are included.

TWELVE NEW SPECIES of North American mosses have recently been described by Dr. Karl Müller (Halle) in *Flora*, No. 14, pp. 219-225. They were collected in Alaska, Colorado, California, Tennessee and Florida. A new species from Labrador is described by Philibert in *Rev. Bryologique*, 1887, p. 55.

BABYHOOD for August has a timely article on poisonous plants, illustrated by accurate wood-cuts. Mothers and nurses are thereby warned against Rhus Toxicodendron, R. venenata, Phytolacca decandra, Conium maculatum, Solanum Dulcamara, Veratrum viride, Datura Stramonium and Hyoscyamus niger. The author should have specified more particularly the poisonous parts of these plants and whether they are poisonous by contact or when eaten.

A CORRE-PONDENT, W. L. Morris, of Des Moines, Iowa, sends to the *Gardeners' Monthly* specimens of Aphyllon fasciculatum growing upon zonale geraniums. The geraniums were raised in pots and from cuttings since October last. The parasites were attached to the roots, and one to the buried stem of the cutting. They probably started from seeds in the potting soil taken from the woods.

THE *Journal of the New York Microscopical Society* is now issued quarterly, instead of in nine numbers a year as heretofore. The price remains unchanged. The two numbers, which form half of the present yearly installment, have been received, and together contain twenty-six pages, seven of which are devoted to original articles and the remainder to the minutes of the society and lists of the publications received.

THE COMMITTEE of the A. A. A. S. to secure more favorable ruling from the U. S. postal officials for the transmission of botanical specimens through the mails made no report at the New York meeting, and the committee was discontinued. The subject was agitated and a committee appointed at the earliest meetings of the Botanical Club, immediately after its organization, and strong efforts in various directions have been made to secure the object in view, but to no purpose. It is to be hoped that some means may yet be found for its accomplishment.

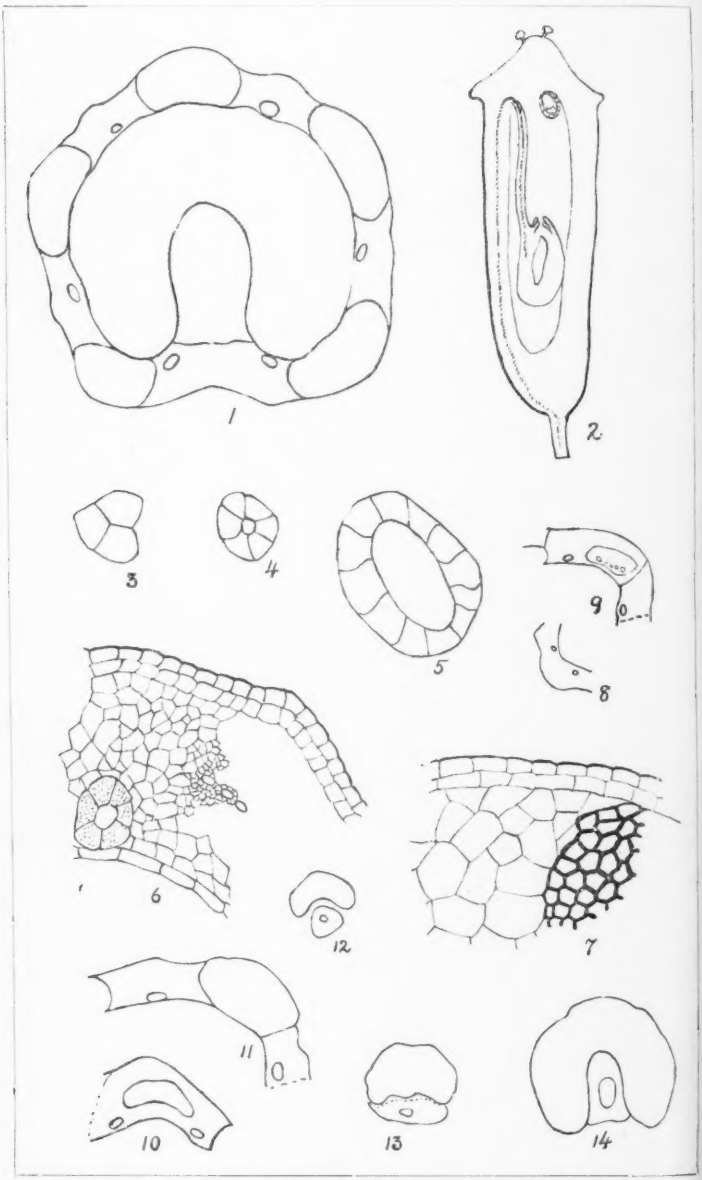
PROFESSOR L. F. WARD and Mr. F. H. Knowlton are collecting fossil plants in the Yellowstone National Park. The latter is giving particular attention to fossil woods, and already has nearly 300 specimens, each representing a separate tree. He writes: "Yesterday I noticed the largest fossil forest that I have yet seen. The largest tree measured twenty-six feet in circumference, and was about twelve feet high. Numerous others still standing ranged from two to seven feet in diameter and five to twenty feet in height, while the ground was literally covered with fallen logs and debris."

OUR READERS very well know the wide divergence of opinion as to the tubercules on roots of Leguminosæ. On June 16 Prof. H. Marshall Ward read a paper before the Royal Society, London, "On the tubercular swellings on the roots of Vicia Faba." Prof. Ward finds a definite fungus, whose affinities are with the Ustilagineæ, living in the tissues of the tubercle and producing by budding at the ends of the hyphæ the minute, germ-like bodies which have been mistaken for bacteria. He has succeeded in infecting the roots of Vicia growing in sterilized soil and in water with this fungus, and has watched its development. The hyphæ enter the root-hairs, cross the cortex and break up into fine branches.

THE REPORT of the Department of Agriculture for 1886, recently issued, contains interesting botanical matter. The botanist's report deals with the history of the division, an account of its work, descriptions of native clovers of economic interest, with five plates, and an article on the weeds of agriculture, by A. A. Crozier, with sixteen plates. The mycologist's report treats of diseases of the grape, celery-leaf blight, orange-leaf scab and potato rot, with seven plates, two maps showing distribution of mildew and black rot of the grape, and diagram showing loss from potato rot, together with an article by J. C. Arthur on pear blight, with a map, and one by W. Trelease on a spot disease of grass, with plate. The report of the forestry division is especially devoted to the practical work of forestry. The report of the bureau of animal industry contains considerable matter relating to bacteria, with several plates showing different forms and colored illustrations of cultures.

ABOUT TWO YEARS ago Mr. Charles Aldrich, of Webster City, Iowa, while making a collection of autographs, wrote to Grant Allen, of England, well known to our readers by his entertaining books on botanical subjects, and received a letter in reply which has recently been published in the *Critic*. The letter contains a statement of what is apparently one of Mr. Allen's inmost grievances; we take from it the following sentences: "For ten years I have been fighting a hard battle against poverty, in writing scientific works; and now I am just being compelled to retire from the hopeless contest and take to penny-a lining for a livelihood at vulgar stories." He ascribes this in some measure to the lack of an international copyright, and says, "While there is only a very small and non paying audience in England for popular scientific books, there is a very large and paying audience in America," the latter buying pirated editions of his works from which he receives no profit. He adds: "I feel it all the harder because I was myself born in America, brought up on one of the Thousand Islands, and taught my first rudiments of higher education beneath the shadow of the elms at Yale College, New Haven."

THE SOCIETY for the Promotion of Agricultural Science held its annual meeting in New York August 8 and 9. The attendance was good and the programme an interesting one. The following is a summary of the papers containing items of botanical interest: "Some suggestions as to experimenting with grasses," by W. J. Beal, formulated the methods by which the best tests of the economic value of grasses can be obtained. "The peg in germinating cucurbitaceous plants," by B. D. Halsted, gives the origin, development and service of this temporary organ. "A hint as to nitrogen appropriation in clovers," by B. D. Halsted, in which the author suggests that the bacteria, which he finds in a slimy envelope about the root-tips of clover, assist in nitrification, and thus render this crop so superior as an accumulator of nitrogen over timothy, which does not possess this special feature. He also thinks that the tubercles on roots of the Leguminosæ aid in the same manner by the active particles within them, which he determines by staining tests to be bacteria. "Hog cholera and swine plague," by D. E. Salmon, contains further data and observations relating to the two distinct germs which severally produce these diseases. "On a new fungus disease of the vine—Greeneria fuliginea," by F. L. Scribner and Pierre Viala, describes an "imperfect" fungus found on the fruit and pedicels of cultivated grapes in North Carolina; both the genus and species are new. "Sorghum as a sugar producing plant," by Harvey W. Wiley. "The absence of certain native plants in soils containing a large percentage of lime," by W. R. Lazenby, is an attempt to explain the distribution of the American chestnut, and of blueberry, huckleberry, trailing arbutus, and other members of the heath family by the amount of lime in the soil. "Old English vegetables," by E. L. Sturtevant, is an enumeration of the plants mentioned in a cookbook intended for the nobility of the time of Richard II, published in England about 1390. "The relative times of germination, leafing, blossoming, and size of fruit of species of American grapes," by T. V. Munson, gives important data in tabulated form of twenty-one species of Vitis in the United States, including one inedited species—V. Texana.



COULTER and ROSE on DEVELOPMENT OF THE UMBELLIFER FRUIT.